

## Results on Northern hake Spanish Discard Sampling Programme

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### Abstract

*Quarterly discards estimates for the Spanish bottom otter trawl fleet fishing in the Northeast Atlantic ICES Subareas VI and VII are presented for hake (*Merluccius merluccius*). Information was obtained by observers on board under different discard sampling programmes carried out by the Spanish research institute IEO. Raising based on effort (number of trips) was used to estimate total quarterly discards in weight and number for the fleet. Discards length distributions are also presented. Both in terms of weight and numbers discards present high variation in time, ranging from 0 to 1100 tonnes and from 0 to 12 million fish. Length distributions of discarded hake show that most of the individuals are juvenile fish, although some individuals above the minimum landing size (27 cm) are also discarded. Increases in the number of juveniles discarded are evident after year 2003.*

*Keywords: Hake, Discards, Northeast Atlantic waters, Bottom Otter Trawl.*

### 1. Introduction

The "Spanish Discards Sampling Programme" was started in 1988. It does not cover every year because its implementation has depended on funding from several national and European research projects, which have not had an annual continuity:

Year	Project
1988-1989	National project
1994	EC Project: Pem/93/005
1997	EC Project: 95/ 094
1999-2000	EC Project: 98/095
2001	EC Project: 99/063
2003-2008	Data Collection Regulation Programme (Spain)

Spanish data on northern hake discards have been provided to ICES WGHMM in the past, but it was not possible to incorporate them in the assessment due to their temporal discontinuity.

The main objective of this working document is to present an update on the quarterly Spanish northern hake discards estimates. Raising to effort (instead of landings, as has been done in the past) is used in this paper based on recommendation from ICES (2007).

## **2. Material and methods**

The sampling strategy and the estimation methodology used in the "Spanish Discards Sampling Programme" are similar since 1988, and are in accordance with the "Workshop on Discard Sampling Methodology and Raising Procedures" guidelines (ICES, 2003). The observers-on-board programme is based on a stratified random sampling design. Métier is the stratum and trips (the sampling units) are randomly selected for sampling within métiers. Until 2009 the DCR asked for annual estimates and, hence, sampling was organised so as to obtain annual results.

The differences between the discards estimates presented here and those previously presented to the ICES WGHMM are that now estimates are presented by quarter (instead of annually) and the raising is done based on quarterly effort (instead of annual landings).

Only the trawl fleet is considered in the Spanish Discards Sampling Programme. This is because previous observations carried out on long line vessels showed low discarding levels for this species and area (Pérez et al., 1996). No information is available for gillnet, but discards of hake in this gear are considered low.

For discards sampling purposes, two métiers are considered within the Spanish trawl fleet operating in the ICES Sub-areas VI and VII, taking into account fishing area, gear and target. One métier is considered to target mainly hake and anglerfish and the other one megrim and anglerfish. Results here are showed for the entire trawl fleet, with both métiers combined.

For each trip sampled, several hauls are, in turn, sampled as follows. A random sample of discarded fish is selected. Hake in the discards sample is measured for length and the weight is calculated using a length/weight relationship (Dorel, 1986; Cull et al., 1989; Pereda and Pérez, 1995). The resulting hake weight in the discards sample is raised to haul level according to the total discarded weight of the haul and the proportion of hake in the sample. Haul-raised data are further raised to trip level taking into account the total number of hauls in the trip. Trip-raised values are subsequently raised to quarterly métier level using the number of trips and the results of the two métiers are then added up to obtain quarterly estimates for the fleet.

The Coefficients of Variation (CV) is presented for discards in weight. This reflects only inter-trip (and not within-trip) variability. If in a quarter only one trip was sampled for one of the métiers, the CV presented is the one obtained for the other métier (with a note to indicate this). It was not possible to calculate a CV in some quarters because only 1 trip was sampled in each métier.

### 3. Results

The sampling level varies depending on the year (Table 1). It has been highest in 1994 and more or less stable since 2003 (Table 1). Between 1988 and 2001, the sampling has had irregular coverage, with significantly higher levels of sampling in 1988 and 1994. The information can be considered representative of the discard behaviour of the whole Spanish trawl fishery exploiting the northern hake stock.

Discard estimates by quarter are shown in weight and number in Table 2 and Figure 1. The CV for weight is also presented in Table 2. Higher discard levels were found since 2004, with extremely high values in 2005 and 2008.

The mean length of individuals discarded has varied along the time series (Figure 2), but no clear trend linked with the enforcement of fishing technical measures was found.

Figure 3 shows the quarterly length composition of the discards. Modes can, to some extent, be followed from one quarter to the next, although the signal is not very strong.

Comparing these results with the recruitment time series (from the last assessment; ICES, 2009), only SP-PGFS data have shown the same increase in recruitment (at age 0) as found in discards in recent years, with a very high value in 2006, in line with the high number of small fish discarded recently.

Finally, annual discards estimates and their CVs are presented in Table 3. In this case, trip values were raised using annual effort by métier. CVs are lower when annual estimates are presented. Figure 4 compares annual discard estimates doing the raising by quarter and by year. Results are similar with both raising procedures.

### References

- ICES, CM. 2003. Report of ICES Workshop on Discard Sampling Methodology and Raising Procedures. Charlottenlund, Denmark, 2-4 September 2003.
- Cull, K.A., A.S. Jeremyn, A.W. Newton, G. I. Henderson, and W.B. Hall. 1989. Length/Weight relationships for 88 species of fish encountered in the North East Atlantic. *Scottish Fisheries Research*. 43: 1-81.
- Dorell, D. 1986. Relations taille/poids pour l'atlantique nord-est. IFREMER DRV/86-001/RH Nantes.
- ICES, CM. 2009. Report of the Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Mergim. ICES CM 2009/ACOM:08.
- ICES, CM. 2007. Report of the Working Group on Discard Raising Procedures. ICES CM 2007 ACFM:06

Pereda, P. and N. Pérez. 1995. Relaciones talla-peso de peces capturados en las campañas de arrastre demersal ò Demersales 0993 y Demersales 0994ö. Inf. Téc. Inst. Esp. Oceanogra., 159:1-16.

Pérez, N., P. Pereda, A. Uriarte, V. Trujillo, I. Olaso y S. Lens. 1996. Discards of the Spanish fleet in ICES Divisions Study Contract DG XIV. PEM/93/005.

**Table 1.** Quarterly discard sampling level and observation effort on board.

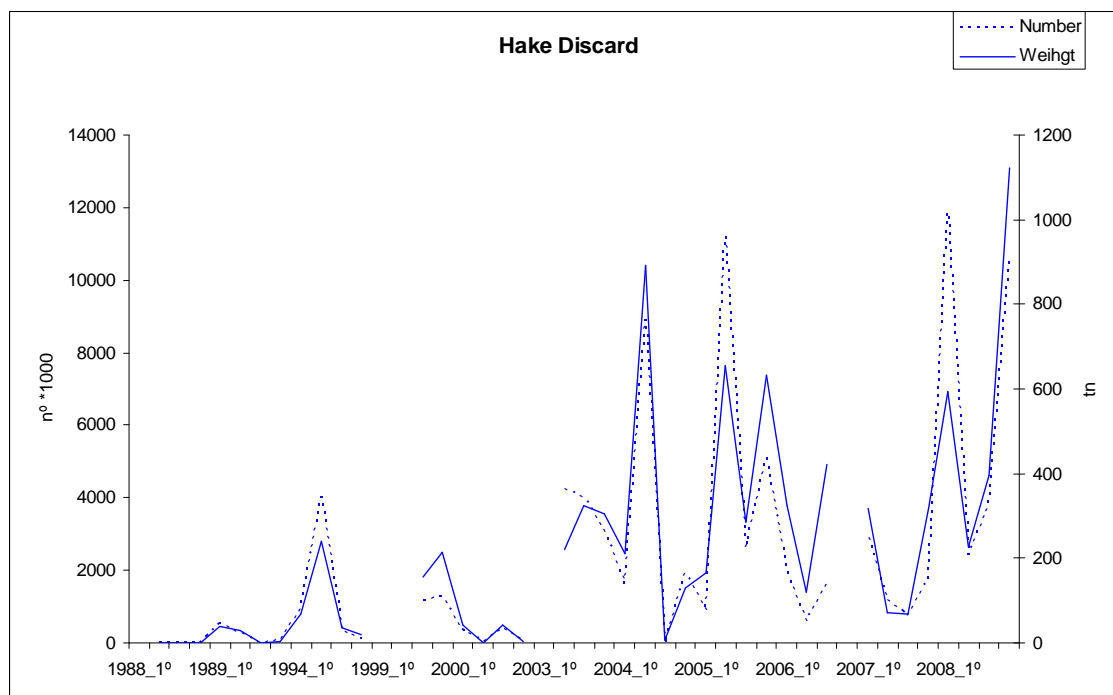
	Quarters	Sampling Trips	Sampling Hauls
1988	2°	4	94
	3°	6	140
	4°	4	137
1989	1°	1	32
	2°	3	65
	3°	2	74
1990-1993	4°	2	61
		<i>NO DATA</i>	
	1°	4	151
1994	2°	5	157
	3°	6	213
	4°	6	182
1997-1998		<i>NO DATA</i>	
	1°		<i>NO DATA</i>
	2°		<i>NO DATA</i>
1999	3°	3	128
	4°	3	102
	1°	3	110
2000	2°	2	91
	3°	3	99
	4°	2	88
2001	1°		<i>NO DATA</i>
	2°	1	54
	3°	1	46
2002	4°		<i>NO DATA</i>
		<i>NO DATA</i>	
	1°		<i>NO DATA</i>
2003	2°	4	107
	3°	4	122
	4°	3	141
2004	1°	3	102
	2°	3	118
	3°	3	86
2005	4°	3	94
	1°	2	71
	2°	3	105
2006	3°	3	109
	4°	3	52
	1°	5	132
2007	2°	5	122
	3°	3	109
	4°	1	14
2008	1°	3	81
	2°	4	100
	3°	3	71
2008	4°	4	116
	1°	2	58
	2°	3	66
2008	3°	4	112
	4°	4	118

**Table 2.** Northern hake quarterly discard estimates in weight (tonnes) and number (in thousands) for the Spanish trawl fishery operating in Sub-area VI-VII.

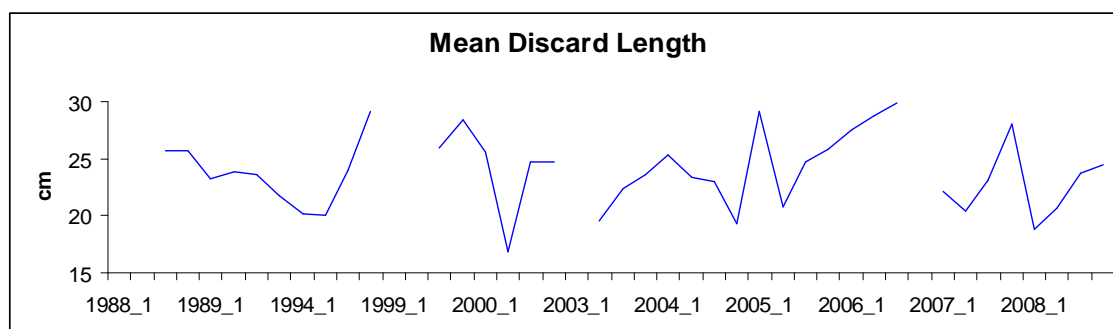
\* CV corresponds only to megrim métier. \*\* CV corresponds only to hake métier

	Quarters	Discard Weight (tn)	CV	Discard Number (thousand)
1988	2°	0.0	0.0**	0.0
	3°	0.7	8.1	5.6
	4°	1.5	6.2	11.1
	1°	39.5	NA	545.2
1989	2°	28.3	6.7*	253.3
	3°	1.1	NA	15.0
	4°	3.6	NA	64.7
1990-1993		NO DATA		
	1°	68.6	2.1	950.5
1994	2°	240.0	2.4	4054.1
	3°	36.1	5.3	350.7
	4°	18.4	2.8	95.0
1997-1998		NO DATA		
	1°		NO DATA	
1999	2°		NO DATA	
	3°	154.4	3.5*	1185.2
	4°	213.3	6.1*	1273.7
	1°	43.6	1.4*	333.2
2000	2°	1.0	6.9*	32.0
	3°	43.5	NA	399.8
	4°	4.8	5.3 *	34.9
2001	1°		NO DATA	
	2° and 3°		NO USED	
	4°		NO DATA	
2002		NO DATA		
	1°		NO DATA	
2003	2°	222.0	2.3*	4246.7
	3°	323.3	3.8*	3995.4
	4°	303.4	2.5*	3067.1
	1°	211.6	3.2*	1624.0
2004	2°	892.7	1.4*	8938.5
	3°	5.77	6.5*	15.3
	4°	130.9	3.7*	1919.3
	1°	166.0	5.7*	887.6
2005	2°	654.9	5.6*	11209.8
	3°	286.2	0.8*	2616.2
	4°	633.2	6.8**	5117.3
	1°	325.7	2.2	1910.7
2006	2°	118.8	4.0	612.9
	3°	422.8	5.0*	1613.2
	4°		NO USED	
	1°	318.2	2.4*	2932.1
2007	2°	72.4	2.6	1183.4
	3°	68.9	4.6*	756.9
	4°	318.8	3.0*	1773.8
	1°	594.1	2.4*	11883.0
2008	2°	226.4	3.0*	2425.3
	3°	395.9	4.1	3796.0
	4°	1122.2	2.8*	10510.8

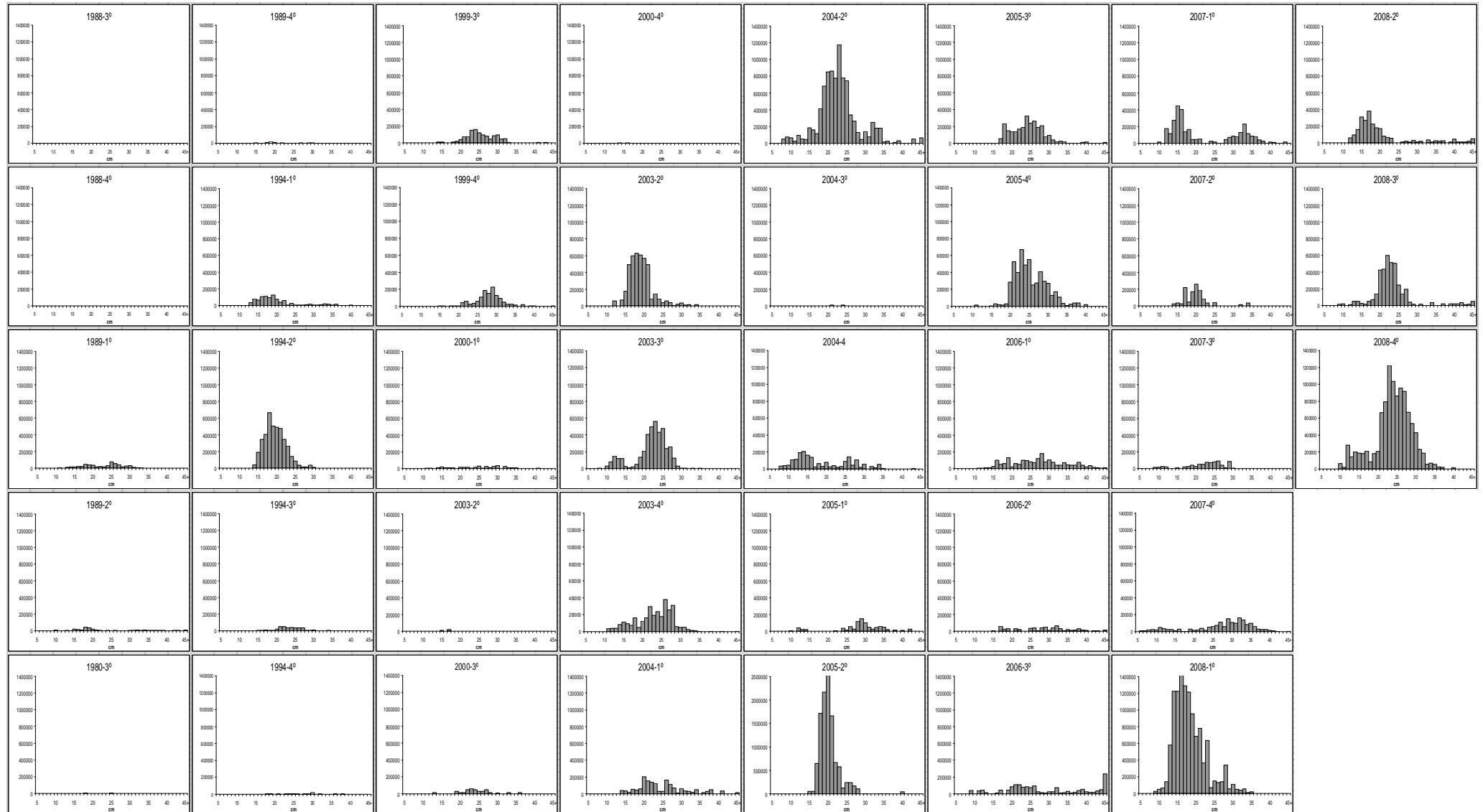
**Figure 1.** Northern hake quarterly discard estimates in weight (tonnes) and number (thousands) for the Spanish trawl fishery operating in Sub-area VI-VII.



**Figure 2.** Mean length size of hake discarded.



**Figure 3.** Quarterly length composition of Spanish trawl discards of hake in ICES Sub-areas VI and VII.





**Table 4.** Northern hake discard estimates (tonnes) of the Spanish trawl fishery operating in Sub-area VI-VII. Raising scheme based on year (not quarter).

Year	Discard Weight (tn)	CV
1988	4.1	0.92
1989	109.1	0.55
1994	296.1	0.39
1999	682.7	0.46
2000	71.1	0.40
2003	1159.1	0.32
2004	1143.0	0.49
2005	1441.7	0.39
2006	939.1	0.25
2007	596.0	0.32
2008	2306.3	0.32

**Figure 3.** Northern hake discard estimates (tonnes) in Sub-area VI-VII. Estimation under different raising schemes (quarterly and annual).

